

Results on Atlantic mackerel Spanish Discard Sampling Programme

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Abstract

*Quarterly discards per ICES Divisions estimates for the Spanish bottom otter trawl fleet fishing in the Northeast Atlantic ICES Subareas VI, VII, VIII and IX are presented for Atlantic mackerel (*Scomber scombrus*). Information was obtained by observers on board under DCF discard sampling program carried out by the Spanish research institute IEO. Raising based on effort (number of trips) was used to estimate discards in weight and number for the most important fleets of Bottom Otter Trawlers. Discards age distributions are also presented.*

No trend is observed in discards volume only a great seasonality with higher discards values generally in the 1st and 4th quarter in Subarea VI_VII, and in the 1st in VIIIc and IXa Divisions. Thus, discards are highly variable throughout the series, both in weight and in number ranging from 30 to 4 580 tonnes per quarter and from 2 to 70 million fish. The highest discard weights are in Divisions VIIj, VIIIc and IXaN. 100% catches are discarded in Sub-areas VI-VII.

Ages modes can, to some extent, be followed from one quarter to the next, especially in Divisions VIIIc-IXaN, although the signal is not very strong.

Keywords: Mackerel, Discards, Northeast Atlantic waters, Bottom Otter Trawl.

1. Introduction

The “Spanish Discards Sampling Programme” was started in 1988. It does not cover every year because its implementation has depended on funding from several national and European research projects, which have not had an annual continuity. For this reason information is presented only since 2003:

Year	Project
1988-1989	National project
1994	EC Project: Pem/93/005
1997	EC Project: 95/ 094
1999-2000	EC Project: 98/095
2001	EC Project: 99/063
2003-2014	Data Collection Regulation Programme (Spain)

Spanish data on Atlantic mackerel discards have been provided to ICES WGWIDE in the past, but it was aggregated by year till 2010 and by Northern and Southern regions for all available series (2003 to 2013).

The main objective of this working document is to present the Spanish Atlantic mackerel discards estimates since 2003 by quarter and Division. Information on sampling discard strategy and discard reasons is also presented.

2. Material and methods

The sampling strategy and the estimation methodology used in the “Spanish Discards Sampling Programme” are similar since 1988, and are in accordance with the “*Workshop on Discard Sampling Methodology and Raising Procedures*” guidelines (ICES, 2003). The observers-on-board programme is based on a stratified random sampling design. Métier is the stratum and trips (the sampling units) are randomly selected for sampling within métiers. Until 2009 the DCR asked for annual estimates and, hence, sampling was organised so as to obtain annual results.

The differences between the discards estimates presented here and those previously presented to the ICES WGWIDE are that now estimates are presented by quarter (instead of annually) and by ICES Divisions. The raising is done based on quarterly effort per métier. Total fleet discard per division are estimations from the total métier discard raising to the effort in each Division. This is because there are Division with no discard sampling per quarter.

Only the trawl fleet is considered for this species from the Spanish Discards Sampling Programme. This is because previous observations carried out on long line vessels showed low discarding levels for this species and area (Pérez et al., 1996). No information is available for gillnet in Sub-areas VI-VII, but discards of Atlantic mackerel in this gear are considered low. Information from the IXaS subdivision is available, but discarded weight is only presented because the samples are very irregular and sampled period shorter.

For discards sampling purposes, two métiers (Castro et al., 2012) are considered within the Spanish trawl fleet operating in the ICES Sub-areas VI and VII, taking into account fishing area, gear and target: One métier OTB_DEF_100-119_0_0 to target mainly hake (*Merluccius merluccius*) and anglerfish (*Lophius piscatorius* and *L. budegassa*) and the other one métier OTB_DEF_70-99_0_0 targeting megrim (*Lepidorhombus whiffiagonis* and *L. boscii*) and anglerfish. It was not possible sampled métier OTB_DEF_100-119_0_0 in 2013 so; discard in the métier OTB_DEF_70-99_0_0 was raised to the both métiers efforts.

Three métiers are considered (Punzón et al., 2010) within the Spanish trawl fleet operating in the ICES Sub-areas VIII and IXa, Northern Spanish coastal bottom otter trawl fleet: One métier OTB_DEF_>=55_0_0 targeting a variety of demersal species in ICES Divisions VIIIc and IXa-North, other coastal bottom otter trawl fleet but with higher vertical open gear OTB_MPD_>=55_0_0 targeting horse mackerel (*Trachurus trachurus*) and/or Atlantic mackerel and a Pair trawler fleet PTB_MPD_>=55_0_0 targeting blue whiting (*Micromesistius poutassou*) and/or hake and/or Atlantic mackerel. Results here are showed for the entire trawl fleet, with metiers combined. Indices are presented for all period and per métier.

For each trip sampled, several hauls are, in turn, sampled as follows. A random sample of discarded species is selected. Atlantic mackerel in the discards sample is measured for length and the weight is calculated using a length/weight relationship (Dorel, 1986; Cull et al., 1989; Pereda and Pérez, 1995). The resulting Atlantic mackerel weight in the discards sample is raised to haul level according to the total discarded weight of the haul and the proportion of Atlantic mackerel in the sample. Haul-raised data are further raised to trip level taking into account the total number of hauls in the trip. Trip-raised weight and length values are subsequently raised to quarterly métier level using the number of trips per métier. Total discard per division are estimated raising the métiers values to total division effort (logbooks values since 2012). Effort per divisions, in years previous to 2012, where information disaggregated per division were not available, was estimated with the proportion of number of trip on division logbook effort, to obtain effort estimates for the fleet.

3. Results

Sampling during 1988 to 2000 was not systematic, thus information are not used for assessment. The sampling level varies depending on the year (Table 1). The information can be considered representative of the discard behaviour of the whole Spanish trawl fishery exploiting the Atlantic mackerel stock.

Discard estimates by ICES Division and quarter are shown in weight and number in Table 2 and Figure 1-2, and per year in Figure 3. Sub-areas VI_VII show high variability along the series, with low discard in years 2005, 2009 and in 2013 (Figure 3). The discard rate does not explain this decrease because 100% of catches are always discarded. Observer on board indices (kg caught per haul) could explain the decrease in 2005 and 2009 (Figure 4). However, the strong effort reduction in 2012 and 2013 period could be the mayor reason for the discard observed decrease in 2013 (Figure 5).

Divisions VIIIc and IXa show two extremely high discard values in 2006 and 2010 (Figure 3) with a sharp drop in the middle. In these both years the three métiers operating in the area present high catch indices (kg caught per haul) in some of the both years (Figure 6). The behaviour patterns of catch indices are highly variable depending on the métier analyzed (Figure 6). Only the OTB_DEF_>=55_0_0 métier shows a gradually decreases in abundance indices since 2004-2006, due probably the specialization of this métiers in high value species as hake, megrims or anglerfishes (Santos et al, 2012). Both métiers (OTB_MPD_>=55_0_0 and PTB_MPD_>=55_0_0) show an increasing trend in catch per haul along the series. The discard rates also vary widely in the zone (Figure 7) but no patten is observed. No effort strong reduction in the period is observed (Figure 8).

Observer on board catch and discard indices (kg per haul) for all métiers show, in general, a gradually increase throughout the series but especially in recent years (Figure 9).

Figures 10 and 11 show the quarterly age composition of the discards. Discards are concentrated in Divisions VIIj, VIIIc and IXaN, what are the areas with the greatest effort of the fleet. Modes can, to some extent, be followed from one quarter to the next, especially in VIIIc and IXa divisions, although the signal is not very strong. High recruitment is observed at age 0 in 2005 in Division VIIIc, which can be followed, moderately well, throughout the series.

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Table 1. Quarterly discard sampling level. Haul observation on board.

Year	Quarter	Via	Vib	VIIb	VIIc	VIIg	VIIh	VIIj	VIIk	VIIlc	IXaN	IXaS
2003	1											
	2				18		5	64	20	36	29	
	3						6	87		37	24	
	4				3			147	19	30	11	
2004	1				30			48	12	41	8	
	2				4			123	3	39	9	
	3		19		20			13	7	30	10	
	4				26			90		34	6	
2005	1				33			38		46	31	5
	2			11	5	5	30	52	2	57	10	20
	3						21	67		63	17	1
	4				4	7		52	9	33	11	
2006	1				2	27		69	10	40	19	
	2			4	20		45	61	15	40	20	9
	3			22	46			41		52	23	20
	4							14		14	7	
2007	1				1	5		65	11	43	4	
	2				27		14	41	17	54	12	12
	3				30			34	2	34	33	16
	4			22	16			75	8	47	29	
2008	1							32		71	14	
	2			9	24	5	29	46	5	56	32	3
	3		32	11	24		11	60	7	49	46	15
	4			1	27			89	14	38	23	
2009	1							60	29	46	16	2
	2			20	48		17	43	26	69	32	6
	3				14	2	5	105	4	81	28	9
	4				59			16	10	57	36	12
2010	1				11			29	24	27	14	2
	2					6	1	91	13	118	15	10
	3				57			10		71	19	10
	4			15	2	1		99	23	59	14	8
2011	1				18			46	10	74	13	5
	2						9	60		91	6	11
	3							92		103	12	12
	4		11		10		20	9	8	88	7	5
2012	1					5	17	88	14	83	15	7
	2					18	4	81		100	18	16
	3							34		75	23	8
	4				7		28	38	6	45	17	9
2013	1					1	41	62		69	5	6
	2						8	93		114	22	12
	3			10	9	4	2	8	1	56	9	8
	4				14		22	40	1	41	8	7

Table 2. Atlantic mackerel quarterly discard estimates in weight (tonnes) and number (in thousands) for the Spanish trawl fishery operating in Sub-areas VI-VII-VIII and IXa per Divisions.

		VIa	VIb	VIIb	VIIc	VIIg	VIIh	VIIj	VIIk	VIIIc	IXa	IXaS
2003	1	0	0	1	4	1	20	57	1	0	0	
	2	0	3	0	10	5	17	43	5	305	170	
	3	0	3	1	4	0	5	24	3	34	19	
	4	0	0	1	2	2	8	25	1	1	1	
2004	1	0	4	8	110	44	261	838	59	439	396	
	2	10	94	50	210	159	328	902	91	23	23	
	3	0	0	0	0	0	0	0	0	17	17	
	4	0	37	48	111	63	179	617	54	6	5	
2005	1	0	9	26	72	22	78	380	34	86	25	
	2	0	2	1	12	3	10	41	14	11	3	
	3	0	2	0	5	1	8	29	4	22	5	
	4	1	5	2	13	3	14	50	6	180	58	
2006	1	0	7	27	73	53	61	310	68	1614	1225	
	2	0	9	11	45	12	38	130	33	363	249	
	3	1	8	9	27	5	28	118	20	41	31	
	4	1	9	12	34	9	27	123	11	48	32	
2007	1	0	28	106	194	37	203	934	62	26	22	
	2	1	5	7	23	4	15	79	12	32	26	
	3	0	1	0	3	0	2	11	2	21	16	
	4	0	2	2	7	3	4	26	3	8	5	
2008	1	0	22	113	326	51	181	1089	166	28	17	
	2	0	4	5	19	5	9	52	15	11	7	
	3	0	2	3	11	5	10	36	5	3	2	
	4	1	1	8	12	4	6	38	5	3	2	
2009	1	1	6	12	27	5	20	121	5	323	222	43
	2	0	9	14	42	11	42	202	20	21	16	24
	3	0	2	3	12	11	22	69	5	65	45	22
	4	0	0	0	0	0	0	0	0	19	13	8
2010	1	0	0	0	9	0	118	1042	110	1793	873	4
	2	25	24	2	39	0	162	823	63	957	685	190
	3	0	0	0	0	0	1	11	1	11	5	26
	4	0	3	0	3	0	31	313	33	32	54	25
2011	1	6	6	15	82	0	28	560	58	176	104	0
	2	108	3	18	84	0	9	254	13	143	63	881
	3	0	0	20	71	4	51	676	0	11	10	363
	4	0	8	9	4	1	20	213	0	31	26	0
2012	1	0	0	0	26	0	184	2526	184	1777	47	26
	2	0	0	0	25	0	25	625	75	64	23	136
	3	0	0	0	2	0	2	58	6	240	40	553
	4	0	0	1	0	0	0	62	5	22	2	154
2013	1	0	0	6	13	16	74	378	0	742	110	47
	2	0	0	4	8	0	12	108	0	141	21	70
	3	0	0	0	0	0	0	7	0	113	3	266
	4	0	0	0	0	0	0	2	0	201	29	5

Figure 1. Atlantic mackerel quarterly discard estimates in weight (tonnes) for the Spanish trawl fishery in ICES Sub-area.

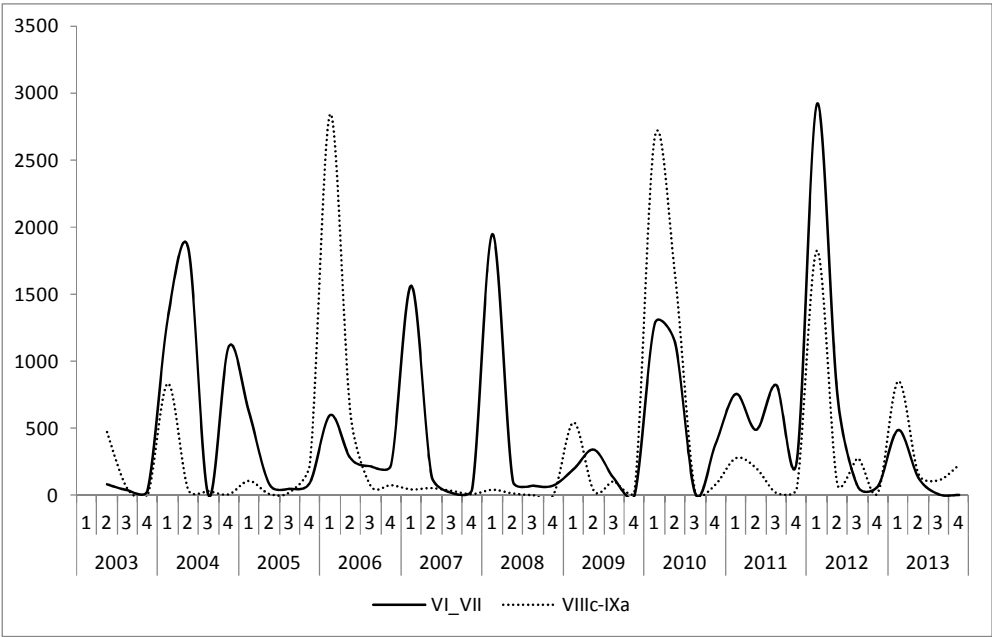


Figure 2. Atlantic mackerel quarterly discard estimates in number (thousands) for the Spanish trawl fishery in ICES Sub-areas.

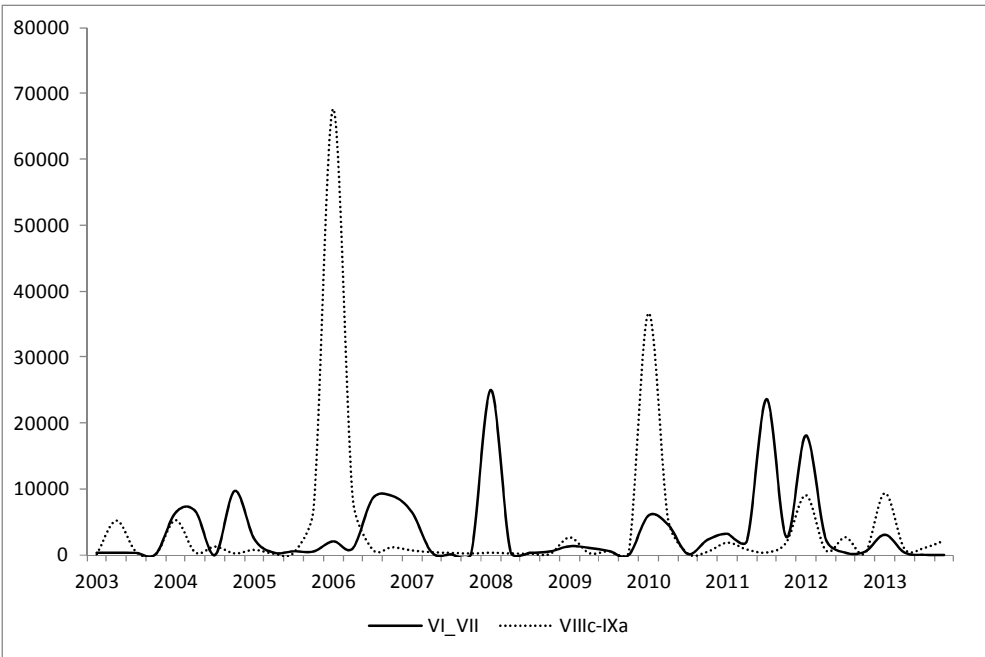


Figure 3. Atlantic mackerel yearly discard estimates in weight (tonnes) for the Spanish trawl fishery in ICES Sub-areas

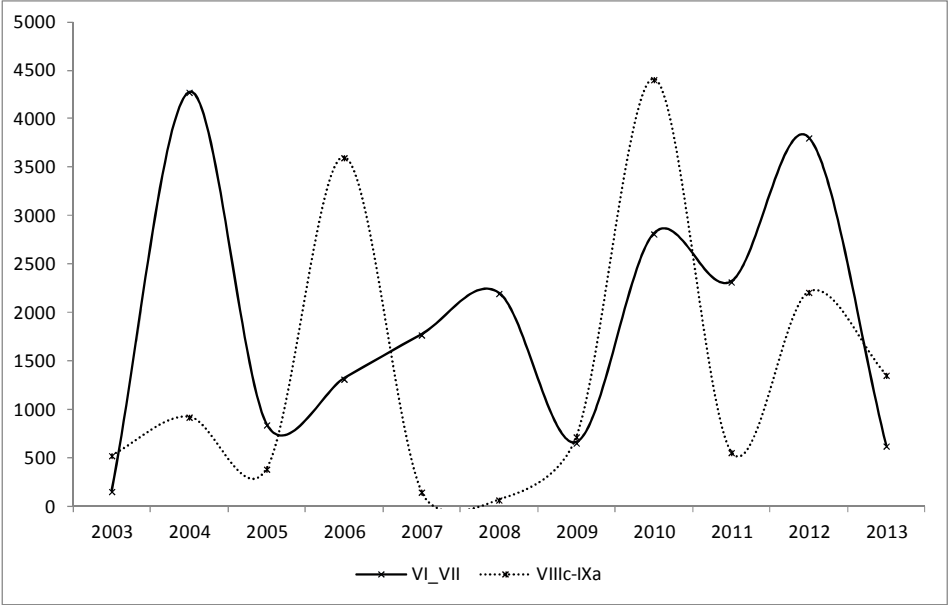


Figure 4. Observer on board indices (kg caught per haul) from métiers operated in Sub-areas VI_VII

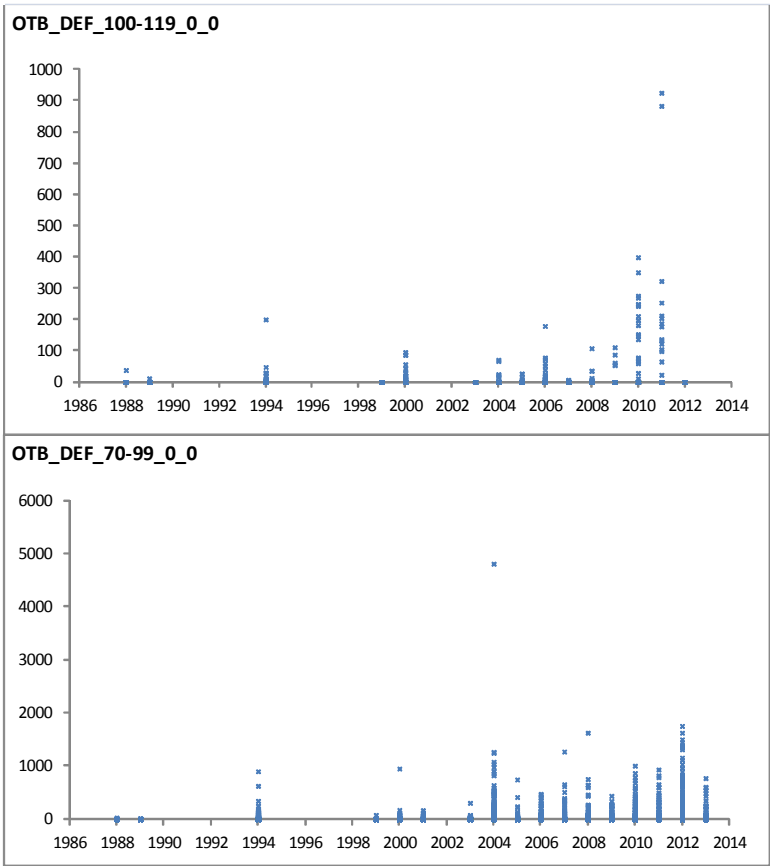


Figure 5. Effort in number of trips in Sub-areas VI_VII

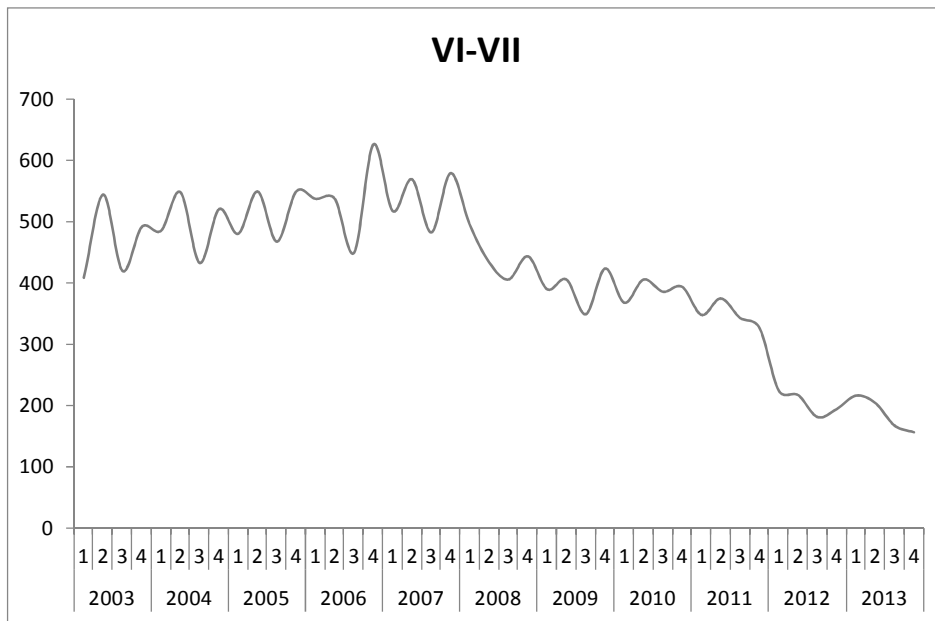


Figure 6. Catch indices, Total Catch per Haul (kg) in observed trips of OTB_DEF_>=55_0_0, OTB_MPD_>=55_0_0 and PTB_MPD_>=55_0_0

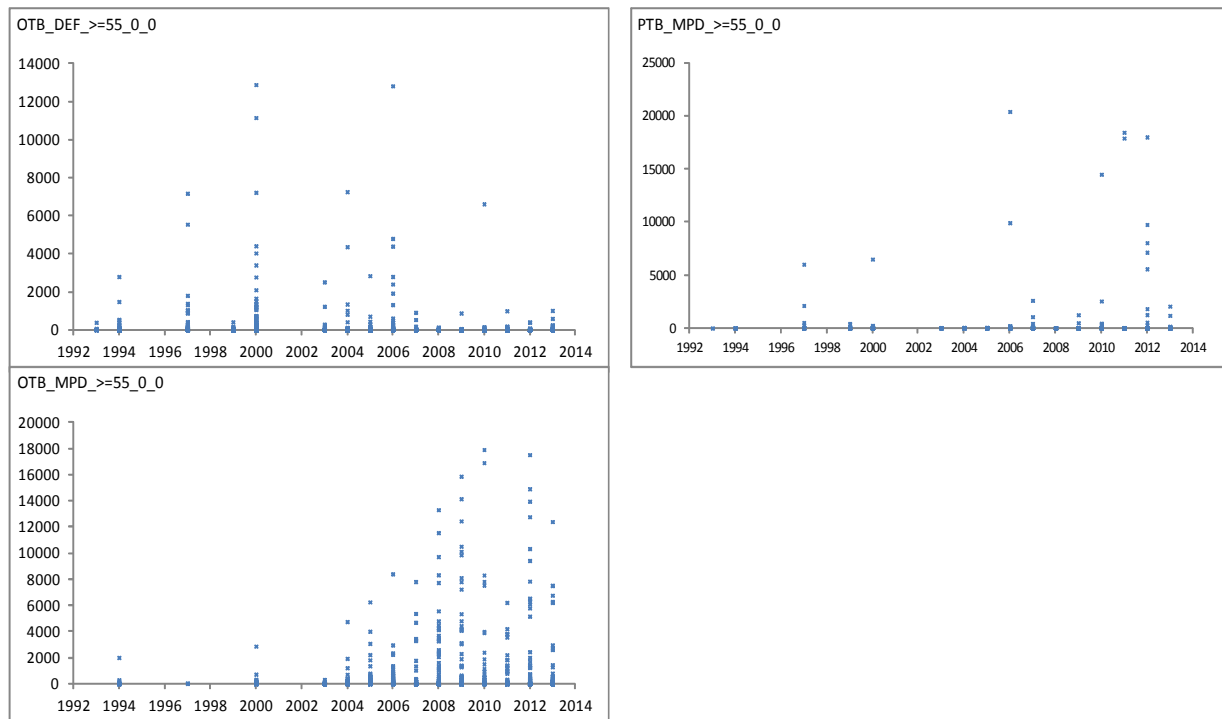


Figure 7. Discard rate (discard weight/catch weight) by métier in Divisions VIIIc and IXa. 1994-2013

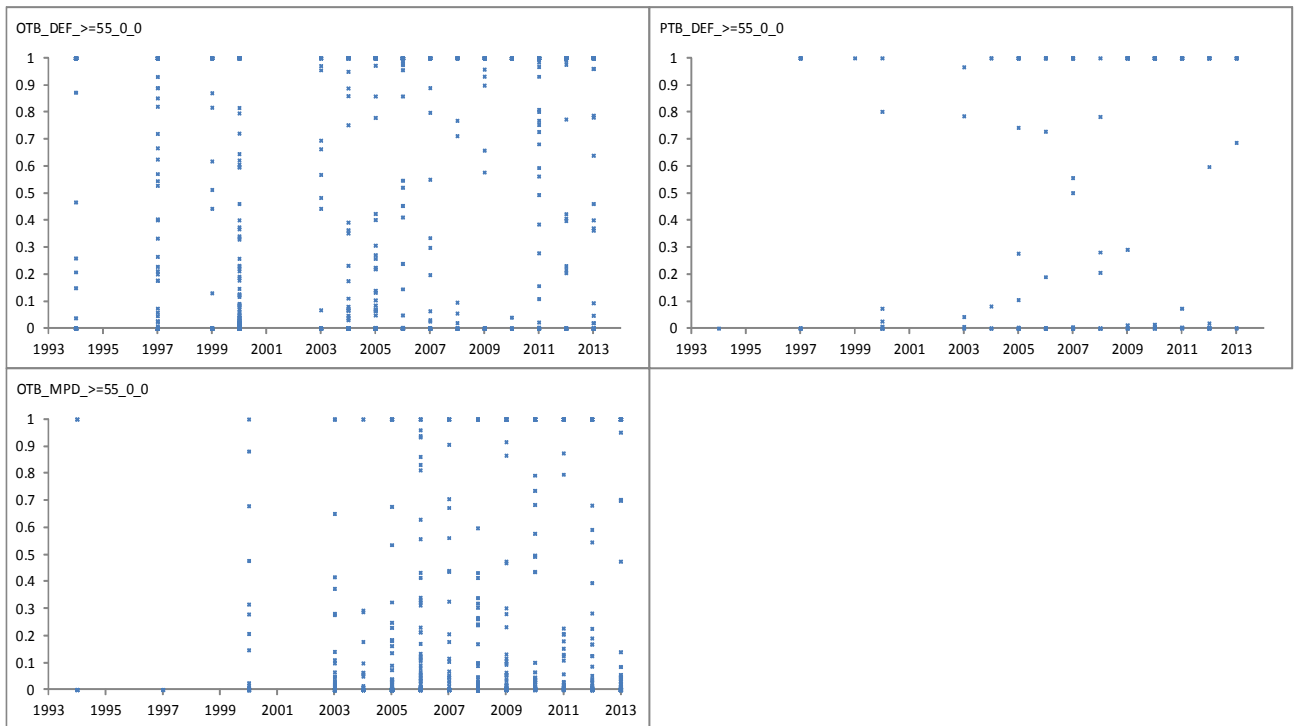


Figure 8. Effort in number of trips in Divisions VIIIc, IXaN

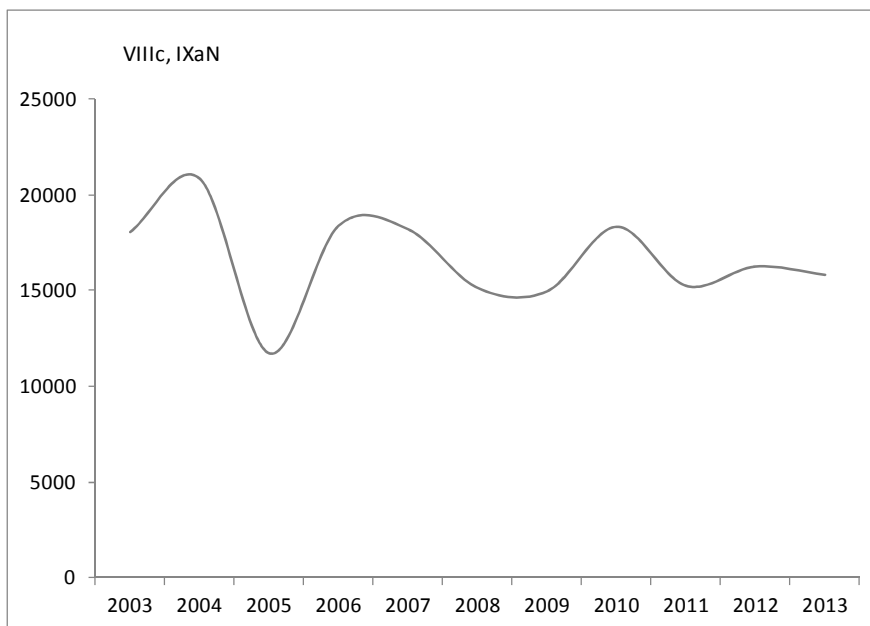


Figure 9. Observer on board indices; kg caught/haul (points, on the left axis) and mean kg caught/haul (line, on the right axis) from all métiers, upper figure and discard indices in lower.

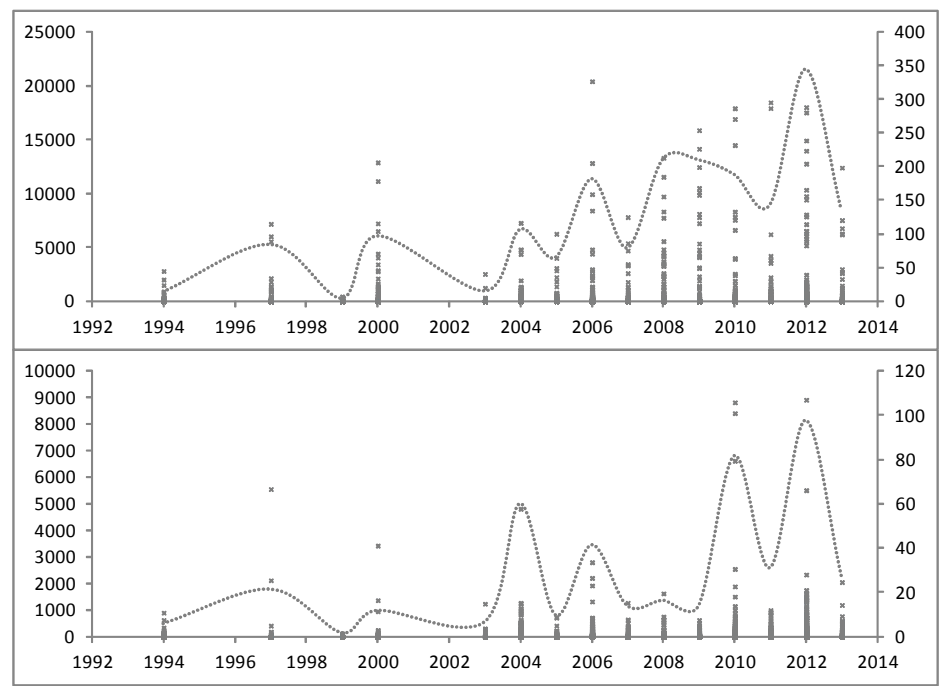


Figure 10. Quarterly age composition of Spanish trawl discards of Atlantic mackerel in ICES Sub-areas VI and VII.



Figure 11. Quarterly age composition of Spanish trawl discards of Atlantic mackerel in ICES Divisions VIIIc-IXaN.

